

## Impact of Artificial Intelligence (AI) on Teacher Self-Efficacy: A Systematic Literature Review

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### Abstract

This systematic literature review (SLR) examined the impact of AI on teacher self-efficacy in empirical studies published between 2024 and 2025. Guided by the PRISMA-2020 framework, peer-reviewed articles were retrieved from major academic databases, including Scopus, Web of Science, ERIC, and Google Scholar. Following rigorous screening and eligibility procedures, 15 empirical studies were included for narrative and thematic synthesis. The findings reveal that teacher self-efficacy functions dynamically within AI-integrated educational environments, operating not only as an outcome of AI literacy, training, and professional development, but also as a mediator and predictor within AI adoption and instructional models. Key antecedents influencing AI-related teacher self-efficacy include AI literacy, attitudes toward AI, AI-TPACK competencies, and pedagogically grounded professional development. Higher levels of self-efficacy were consistently associated with positive instructional intentions, sustained AI integration, and adaptive professional engagement. However, the review also highlights notable gaps, including the predominance of cross-sectional designs, limited focus on in-service teachers, and conceptual inconsistencies in measuring AI-related self-efficacy. The study concludes that strengthening teacher self-efficacy should be a central objective of AI-oriented teacher education and professional development.

**Keywords:** AI in Education, Teacher Self-Efficacy, Generative AI, Systematic Literature Review

### Introduction

Artificial Intelligence (AI) has rapidly transitioned from an emerging technology to a transformative force within education systems worldwide (Huong, 2024; Garzón et al., 2025). Recent advances in machine learning, generative AI, and intelligent educational applications have reshaped how teaching, learning, assessment, and professional development are conceptualized and enacted (Baskara, 2024; Bahroun et al., 2023). Teachers are no longer only end-users of educational technologies; rather, they are increasingly expected to critically evaluate, integrate, and pedagogically leverage AI-driven tools in classrooms and teacher education programs (Alejandro et al., 2024; Bergdahl & Sjöberg, 2025; Tram, 2025). This shift has foregrounded the human dimensions of AI integration—particularly teachers' beliefs, attitudes, competencies, and

self-perceptions—as central determinants of meaningful and ethical AI adoption in education (Collie et al., 2024; Runge et al., 2025). Among these human factors, teacher self-efficacy has emerged as a pivotal construct in understanding teachers' engagement with AI. Teacher self-efficacy refers to educators' beliefs in their capability to plan, organize, and execute instructional practices that lead to desired learning outcomes (Bandura, 1997; Lu et al., 2024). Empirical evidence increasingly suggests that teachers with higher levels of AI-related self-efficacy are more likely to view AI as an instructional resource rather than a threat to professional autonomy (Bergdahl & Sjöberg, 2025). The rapid infusion of AI into educational contexts has intensified scholarly attention on AI-related teacher self-efficacy, including confidence in using AI tools, beliefs about AI's instructional value, and perceived capability to manage AI-supported teaching and learning processes. Recent studies have examined how teacher self-efficacy is shaped by AI literacy, technology acceptance, pedagogical knowledge, and structured AI training experiences (Alejandro et al., 2024; Veena, 2025). Research focusing on pre-service teachers has highlighted self-efficacy as a key mediator between AI usage and instructional readiness, particularly in relation to generative AI tools such as ChatGPT (Asare & Boateng, 2025; Yu et al., 2025).

Despite this growing body of empirical research, the literature on AI and teacher self-efficacy remains fragmented. Existing studies vary considerably in terms of educational level (pre-service vs. in-service teachers), theoretical grounding (e.g., TAM, UTAUT, AI-TPACK), AI applications examined (e.g., generative AI, AI-based mobile applications), and methodological approaches. Moreover, some studies conceptualize self-efficacy as an outcome of AI use (Lu et al., 2024; Veena, 2025), while others position it as a mediator or antecedent influencing AI adoption and instructional effectiveness (Asare & Boateng, 2025; Collie et al., 2024). This conceptual and methodological diversity complicates efforts to draw integrated conclusions about the overall impact of AI on teacher self-efficacy. Furthermore, the rapid emergence of generative AI tools has accelerated research output, particularly during 2024–2025, creating an urgent need for systematic synthesis. While individual studies provide valuable insights into specific contexts, no comprehensive systematic literature review has yet consolidated recent empirical evidence on how AI influences teacher self-efficacy across educational settings and theoretical frameworks. The present study aims to address this gap by conducting a systematic literature review of empirical studies published between 2024 and 2025 that examine the relationship between AI and teacher self-efficacy. By synthesizing findings across diverse contexts, this review seeks to (a) map dominant research trends, (b) identify key determinants and outcomes of AI-related teacher self-efficacy, and (c) highlight methodological patterns and research gaps. Through this synthesis, the study contributes to a clearer and evidence-based understanding of how AI is reshaping teachers' professional confidence and instructional capacity, thereby informing teacher education, professional development, and future research in AI-enhanced education.

### **Research Questions**

**RQ1.** How has recent empirical research (2024–2025) conceptualized and investigated the relationship between artificial intelligence (AI) and teacher self-efficacy across educational contexts?

**RQ2.** What key factors and mechanisms influence teacher self-efficacy in AI-integrated teaching environments, and how does self-efficacy function within AI integration models (e.g., as an outcome, mediator, or predictor)?

**RQ3.** What instructional, professional, and research implications emerge from existing studies on AI and teacher self-efficacy, and what gaps should guide future research?

## **Literature Review**

### **Artificial Intelligence in Education and the Centrality of Teachers**

The integration of artificial intelligence (AI) into education has expanded rapidly, encompassing applications such as intelligent tutoring systems, adaptive learning platforms, AI-based mobile applications, and, more recently, generative AI tools like ChatGPT. While early discussions of AI in education focused primarily on technological capabilities and learning analytics, recent scholarship increasingly emphasizes the role of teachers as key agents in mediating AI's pedagogical value (Alejandro et al., 2024; Tram, 2025). Teachers' perceptions, competencies, and beliefs shape not only whether AI is adopted, but also how it is used to support instructional goals. Empirical studies conducted across K–12, higher education, and teacher education contexts suggest that teachers' responses to AI are multifaceted, ranging from optimism about instructional efficiency to concerns about pedagogical control and ethical implications (Bergdahl & Sjöberg, 2025). These findings reinforce the view that successful AI integration is not solely a technical challenge, but a socio-cognitive process influenced by teachers' professional confidence and readiness.

### **Teacher Self-Efficacy in AI-Integrated Contexts**

Teacher self-efficacy has long been recognized as a critical determinant of instructional innovation and technology use. In AI-enhanced educational settings, self-efficacy refers to teachers' perceived capability to understand, implement, and manage AI-supported teaching and learning processes. Recent studies demonstrate that AI-related self-efficacy significantly influences teachers' willingness to experiment with AI tools, persist through implementation challenges, and align AI use with pedagogical objectives (Lu et al., 2024; Yehya et al., 2025). Several studies conceptualize self-efficacy as a direct outcome of AI exposure and professional development. For instance, professional learning interventions incorporating generative AI have been shown to enhance teachers' higher-order thinking and instructional self-efficacy (Lu et al., 2024). Similarly, research on AI literacy highlights that increased understanding of AI concepts is positively associated with teaching self-efficacy, particularly among pre-service teachers (Veena, 2025). These findings suggest that structured engagement with AI can strengthen teachers' confidence when pedagogically scaffolded.

### **Self-Efficacy as a Mediator and Predictor of AI Integration**

Beyond being an outcome, teacher self-efficacy is frequently positioned as a mediating or predictive variable within AI integration models. Studies drawing on technology acceptance frameworks indicate that self-efficacy mediates the relationship between AI usage and instructional readiness. For example, research on pre-service mathematics teachers demonstrates that self-awareness and self-regulatory learning mediate the effects of ChatGPT use on teaching self-efficacy (Asare & Boateng, 2025). Similarly, large-scale studies examining generative AI in professional contexts identify teacher self-efficacy as a predictor of AI valuing and classroom integration, operating alongside job resources and institutional demands (Collie et al., 2024). Subject-specific investigations—in areas such as language education, physics, and special education—consistently show that teachers with higher AI-related self-efficacy are more likely to adopt AI tools meaningfully and sustain their use over time (Ajrlouni et al., 2025; Liu et al., 2025; Yehya et al., 2025).

### **AI-TPACK and Intelligent-TPACK Frameworks**

Recent literature reflects a conceptual shift toward domain-specific models that integrate AI knowledge with pedagogy and content. The emergence of AI-TPACK and intelligent-TPACK frameworks represents an effort to move beyond general technology competence and capture teachers' pedagogical readiness for AI-enhanced instruction. Studies employing these frameworks

consistently identify self-efficacy as a central mechanism linking AI knowledge to instructional intentions and classroom practice (Ismaniati et al., 2025; Runge et al., 2025). Empirical evidence suggests that teachers' confidence in their AI-related pedagogical competence is closely associated with perceived readiness, affective dispositions, and acceptance of AI technologies (Sadaf et al., 2025). Research on pre-service teachers further indicates that AI-related coursework and training experiences significantly strengthen AI-TPACK and, in turn, enhance teaching self-efficacy (Runge et al., 2025; Yu et al., 2025). These findings highlight the importance of embedding AI meaningfully within teacher education curricula rather than treating it as an add-on skill.

### **Contextual and Disciplinary Variations**

The impact of AI on teacher self-efficacy also varies across educational contexts and subject domains. Studies conducted in K–12 settings emphasize the role of institutional support and cultural perceptions of AI in shaping teachers' confidence (Bergdahl & Sjöberg, 2025). In contrast, research focusing on pre-service teachers often highlights developmental factors, such as prior technological exposure and reflective practice, as critical influences on self-efficacy formation (Alejandro et al., 2024; Yu et al., 2025). Disciplinary studies reveal that AI self-efficacy manifests differently depending on subject-specific pedagogical demands. For instance, physics and language education studies demonstrate that teachers' confidence in using AI is closely linked to perceived alignment between AI tools and subject learning objectives (Liu et al., 2025; Yehya et al., 2025). These contextual variations underscore the need for nuanced, discipline-sensitive approaches to AI professional development. While generative AI has received increasing attention, empirical research remains concentrated in pre-service teacher populations, with comparatively fewer studies examining in-service teachers across diverse educational systems. These gaps point to the need for integrative syntheses—such as the present systematic literature review—to consolidate findings, clarify conceptual pathways, and inform future research and practice.

### **Research Methodology**

#### **Research Design**

This study adopted a systematic literature review (SLR) design to synthesize empirical evidence on the impact of artificial intelligence (AI) on teacher self-efficacy. The review was conducted in accordance with the PRISMA-2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency, rigor, and replicability in the identification, screening, eligibility assessment, and inclusion of studies (Page et al., 2021). A systematic approach was chosen to minimize selection bias and to provide a comprehensive and structured synthesis of recent research findings.

#### **Search Strategy**

A comprehensive literature search was conducted across major academic databases commonly used in education and educational technology research, including Scopus, Web of Science, ERIC, and Google Scholar. The search focused on peer-reviewed journal articles published between 2024 and 2025, reflecting the most recent phase of accelerated research on AI in education, particularly following the widespread adoption of generative AI tools. Search strings were developed using combinations of keywords and Boolean operators, such as: “artificial intelligence” or “AI” or “generative AI” or “ChatGPT” and “teacher self-efficacy” or “teaching self-efficacy” or “AI self-efficacy” and “teachers” or “pre-service teachers” or “in-service teachers”. Backward and forward citation tracking was also conducted to identify additional relevant studies. Clear inclusion and exclusion criteria were established prior to the screening process to ensure consistency and relevance. Studies were included based on the following criteria:

- Empirical studies published in peer-reviewed journals

- Studies published between 2024 and 2025
- Research examining AI and teacher self-efficacy
- Studies involving pre-service or in-service teachers
- Quantitative, qualitative, or mixed-methods designs
- Articles published in English

Studies were excluded based on the following criteria:

- Conceptual, opinion, editorial, or commentary papers
- Studies focusing solely on student self-efficacy without teacher-related analysis
- Research addressing general educational technology without explicit reference to AI
- Conference papers, dissertations, reports, or non-peer-reviewed sources

### **Study Selection Process**

The study selection process followed the four PRISMA-2020 phases: identification, screening, eligibility, and inclusion. Initially, database searches yielded a larger pool of records. After removing duplicates, titles and abstracts were screened for relevance based on the inclusion criteria. Full-text articles were then assessed for eligibility. Studies that did not explicitly address teacher self-efficacy in relation to AI were excluded at this stage. Following this process, 15 empirical studies met all inclusion criteria and were included in the final synthesis.

### **Data Extraction, Synthesis and Analysis**

A structured data extraction protocol was employed to systematically collect relevant information from each included study. Extracted data included:

- Author(s) and year of publication
- Country and educational context
- Participant characteristics (pre-service/in-service teachers)
- Research design and methodology
- Type of AI technology examined
- Conceptual or theoretical framework
- Measurement of teacher self-efficacy
- Key findings related to AI and teacher self-efficacy

Given the heterogeneity of research designs, contexts, and outcome measures, a narrative and thematic synthesis approach was adopted rather than a meta-analysis. Studies were grouped and analyzed according to recurring themes aligned with the research questions, including:

- Conceptualization and measurement of AI-related teacher self-efficacy
- Antecedents influencing teacher self-efficacy
- The role of self-efficacy as an outcome, mediator, or predictor
- Instructional and professional outcomes associated with AI self-efficacy

This thematic synthesis enabled the identification of patterns, convergences, and divergences across studies, providing an integrated understanding of the impact of AI on teacher self-efficacy.

## **Findings**

The thematic synthesis of the 15 empirical studies published between 2024 and 2025 yielded four overarching themes aligned with the research questions: (i) research trends and methodological characteristics, (ii) the role of teacher self-efficacy within AI integration models, (iii) key antecedents influencing AI-related teacher self-efficacy, and (iv) instructional and professional implications.

### **Research Trends and Methodological Characteristics**

Analysis of the included studies reveals a rapid expansion of empirical research examining AI and teacher self-efficacy, with a notable concentration in the years 2024–2025. Most studies employed quantitative survey-based designs, often using structural equation modeling or regression analyses to examine relationships among AI-related variables (e.g., Alejandro et al., 2024; Collie et al., 2024; Runge et al., 2025). A smaller number of studies adopted mixed-methods or qualitative approaches, particularly those exploring pre-service teachers' experiences with generative AI tools such as ChatGPT (Yu et al., 2025). In terms of participants, the literature is heavily skewed toward pre-service teachers, especially in teacher education programs (Alejandro et al., 2024; Asare & Boateng, 2025; Sadaf et al., 2025). Fewer studies focused exclusively on in-service teachers, though those that did often examined workplace integration and professional demands (Collie et al., 2024; Yehya et al., 2025). Geographically, studies were conducted across diverse regions, including Europe, Asia, the Middle East, and South Asia, indicating growing global interest in AI-related teacher self-efficacy. Theoretical grounding varied, with frequent use of technology acceptance models (TAM/UTAUT) and AI-TPACK or intelligent-TPACK frameworks. This diversity reflects an emerging but still fragmented theoretical landscape, with no single dominant model guiding the field.

### **The Role of Teacher Self-Efficacy within AI Integration Models**

Across the reviewed studies, teacher self-efficacy was conceptualized in three primary ways: as an outcome of AI engagement, a mediating mechanism, and a predictor of AI integration and instructional practice. Several studies positioned teacher self-efficacy as a direct outcome of AI-related experiences, such as professional development, AI literacy acquisition, or hands-on engagement with generative AI tools. For example, Lu et al. (2024) demonstrated that participation in generative AI-supported professional development significantly enhanced teachers' instructional self-efficacy and higher-order thinking. Similarly, Veena (2025) found a positive association between AI literacy and teaching self-efficacy among prospective teachers, suggesting that conceptual understanding of AI strengthens professional confidence. A growing number of studies identified self-efficacy as a mediating variable linking AI usage to instructional readiness or pedagogical outcomes. Asare and Boateng (2025) reported that self-awareness and self-regulatory learning mediated the relationship between ChatGPT usage and pre-service mathematics teachers' self-efficacy. Likewise, Ismaniati et al. (2025) showed that self-efficacy mediated the relationship between teachers' TPACK and their intentions to adopt AI, underscoring its central role in AI adoption pathways. Other studies conceptualized self-efficacy as a predictor of AI integration, influencing teachers' valuing of AI, instructional intentions, and sustained use. Collie et al. (2024) found that teachers with higher generative AI self-efficacy were more likely to integrate AI into their professional practice, particularly when supported by favorable job resources. Subject-specific research in physics, language education, and special education similarly identified self-efficacy as a key determinant of effective AI use (Ajlouni et al., 2025; Liu et al., 2025; Yehya et al., 2025). Collectively, these findings position teacher self-efficacy as a dynamic construct, operating at multiple points within AI integration models rather than as a static outcome.

### **Key Antecedents Influencing AI-Related Teacher Self-Efficacy**

The synthesis identified several recurring antecedents that consistently influenced teacher self-efficacy in AI-integrated contexts. First, AI literacy and knowledge emerged as foundational. Teachers with higher levels of AI understanding reported greater confidence and readiness to integrate AI into instruction (Veena, 2025; Bergdahl & Sjöberg, 2025). Second, attitudes toward AI—including perceived usefulness and ethical comfort—were strongly associated with self-efficacy (Erol et al., 2025; Bergdahl & Sjöberg, 2025). Third, AI-TPACK and intelligent-TPACK competencies were among the most robust predictors of self-efficacy. Studies consistently showed that teachers who perceived themselves as capable of pedagogically aligning AI with content knowledge exhibited higher teaching self-efficacy and readiness (Runge et al., 2025; Sadaf et al., 2025; Tram, 2025). Finally, structured training and professional development played a critical role, particularly when AI learning was embedded within pedagogical contexts rather than delivered as isolated technical instruction (Lu et al., 2024; Yu et al., 2025).

### **Instructional and Professional Outcomes of AI-Related Self-Efficacy**

Higher levels of AI-related teacher self-efficacy were consistently associated with positive instructional and professional outcomes. These included greater willingness to experiment with AI tools, stronger intentions to integrate AI into lesson planning, and more reflective pedagogical practices (Collie et al., 2024; Yu et al., 2025). In some cases, teacher self-efficacy was also indirectly linked to student learning outcomes, such as improved second-language achievement when teachers effectively combined generative AI use with reflective instruction (Liu et al., 2025). At the professional level, self-efficacy supported adaptive responses to AI-related demands, reducing anxiety and resistance while fostering proactive engagement with emerging technologies (Bergdahl & Sjöberg, 2025). These findings highlight self-efficacy as a critical leverage point for sustainable and responsible AI integration in education. Despite consistent findings, several gaps were evident. Most studies relied on cross-sectional designs, limiting insights into how teacher self-efficacy evolves over time. Longitudinal and intervention-based research remains scarce. Additionally, the dominance of pre-service teacher samples suggests a need for greater attention to in-service teachers, particularly in underrepresented regions and educational systems. Conceptual inconsistencies in defining and measuring AI-related self-efficacy also limit comparability across studies. Finally, although generative AI is increasingly examined, empirical work remains fragmented, underscoring the need for integrative models that connect AI literacy, pedagogical competence, and self-efficacy within coherent theoretical frameworks.

### **Discussion & Conclusion**

The purpose of this systematic literature review was to synthesize recent empirical evidence on the impact of artificial intelligence (AI) on teacher self-efficacy. The findings reveal that teacher self-efficacy occupies a central and dynamic position in AI-integrated educational contexts, functioning not only as an outcome of AI engagement but also as a mediator and predictor within broader models of AI adoption and instructional practice. This discussion interprets these findings in relation to existing theoretical perspectives, highlights their practical significance, and identifies directions for future research. One of the most salient insights from this review is the convergence of recent studies around teacher self-efficacy as a core psychological mechanism in AI integration. Across diverse contexts and AI applications, self-efficacy consistently emerged as a decisive factor shaping teachers' willingness to adopt AI, their persistence in implementation, and the pedagogical depth of AI use. This finding extends established understandings of teacher self-efficacy in technology-enhanced learning by demonstrating its heightened importance in AI-driven environments, which are often perceived as complex, opaque, and rapidly evolving (Zimu, 2024; Lu et al., 2024; Kopcha & Alger, 2011). A key contribution of this review lies in clarifying the

multiple functional roles of teacher self-efficacy within AI integration models. The findings indicate that self-efficacy operates simultaneously as: an outcome, influenced by AI literacy, training, and hands-on experience; a mediator, linking AI use and pedagogical readiness; and a predictor, shaping teachers' intentions, valuing of AI, and instructional practices. This multidimensional role suggests that linear models of AI adoption may be insufficient. Instead, AI integration appears to involve reciprocal relationships, where increased AI use enhances self-efficacy, which in turn promotes deeper and more sustained AI integration. Such reciprocal dynamics align with social-cognitive perspectives on professional learning and underscore the need for integrative theoretical frameworks that position self-efficacy at the center of AI adoption processes (Zhang, 2025). The prominence of AI-TPACK and intelligent-TPACK frameworks in recent studies (Radloff et al., 2025; Sulistiani et al., 2024) signals a conceptual maturation in the field. Rather than focusing solely on technical competence, these frameworks emphasize the integration of AI knowledge with pedagogy and content. The review demonstrates that teacher self-efficacy is most strongly associated with AI integration when teachers perceive themselves as pedagogically competent, not merely technically skilled. Thus, teacher self-efficacy serves as a bridge between AI knowledge and pedagogical enactment, reinforcing the value of AI-TPACK-informed professional development models. The emergence of generative AI tools introduces both opportunities and challenges for teacher self-efficacy. While several studies report positive associations between generative AI use and teaching confidence, the findings also suggest underlying tensions related to instructional control, ethical concerns, and professional identity. This underscores the importance of reflective practice, ethical guidance, and policy-aligned professional development in mitigating anxiety and fostering confident, responsible AI use.

### **Implications**

The findings of this review carry significant implications for teacher education and professional development. First, AI-related teacher self-efficacy should be treated as a deliberate learning outcome rather than an incidental by-product of technology exposure. Teacher preparation programs need to integrate AI literacy, pedagogical application, and reflective practice in a coherent manner. Second, professional development initiatives should move beyond one-off AI workshops toward sustained, practice-embedded learning experiences that allow teachers to experiment with AI tools in authentic instructional contexts. Such approaches are more likely to strengthen self-efficacy and promote long-term instructional change. Finally, policymakers and educational leaders should recognize that building teacher self-efficacy is a strategic investment. Institutional support, clear guidelines, and ethical frameworks can significantly influence teachers' confidence and willingness to engage with AI, thereby shaping the success of AI integration at the system level.

### **Limitations**

While this systematic literature review provides a comprehensive synthesis of recent empirical research on AI and teacher self-efficacy, several limitations should be acknowledged. First, the review was restricted to peer-reviewed journal articles published between 2024 and 2025. As a result, the findings primarily reflect contemporary trends rather than long-term developments in the field. Second, only studies published in English-language journals were included, which may have limited the representation of research conducted in non-English-speaking contexts. Finally, most of the reviewed studies relied on self-reported data and cross-sectional designs, which may be susceptible to response bias and do not capture changes in teacher self-efficacy over time. These limitations should be considered when interpreting the findings of the review.

## Directions for Future Research

Building on the findings and limitations of this review, several directions for future research are proposed. First, there is a clear need for longitudinal and intervention-based studies that examine how teacher self-efficacy related to AI develops over time and in response to targeted professional development initiatives. Such designs would enable stronger causal inferences and provide insights into the sustainability of AI-related confidence and competence. Second, future research should broaden its focus to include in-service teachers across diverse educational systems, particularly in underrepresented regions and low-resource contexts. Finally, as generative AI continues to evolve, future research should examine the ethical, emotional, and identity-related dimensions of teacher self-efficacy. Understanding how issues such as autonomy, accountability, and professional agency intersect with AI use will be critical for designing teacher education programs that promote confident, ethical, and pedagogically grounded AI integration.

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